THE ONLINE CASE STUDY DEVELOPMENT FOR THE TEACHING OF BUILDING STRUCTURES REINFORCEMENT

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Abstract

The Reinforcement of Building Structures is one of the topics of the Master in Building Innovation Technology (MBIT) of Universidad Politécnica de Madrid (UPM).

Since the beginning of the delivery of this master, case studies have been chosen as the teaching methodology. For the 2011-2012 course the online education of this subject was implemented, instead of the classical learning based on attendance.

Through ICT's (Information and Communication Technologies) students are provided with much more and more selective information than through the classical learning. ICT's can be used for search, enquiries and reporting. Using the online tools has been proved, through the results obtained and based on the surveys made amongst students, to be a successful experience.

1 INTRODUCTION

The incorporation of the Spanish University Educational System to the European Space of Higher Education (EHEA) demands from the Universities the adaptation of the degrees according to common structures. These new university educational approaches involve the change of the existing degree of Technical Architecture by the Building Engineering.

The educational organization created by the EHEA, resulted in the implementation of the credit system and is based on the reduction of the number of hours of class in favor of number of working hour of the student. From the educational point of view, the result is the reduction of class hours on-site for practices supervised by the teaching staff. Higher education will be divided into two cycles, a generalist orientation degree and a postgraduate degree of specialist guidance [1],[2],[3].

We must emphasize that the principle that articulates this system is the acquisition of skills, opposite to the acquisition of knowledge, so these degrees and postgraduate courses will be strongly directed to give answer to the labor needs that exist in the society [4-6]

Currently, at Technical Architecture School, two different postdegree studies are taught: master's degree in construction management (MAGE) and master's degree in Building Innovation Technology (MITE)

There are many advantages to online and computer-based learning when compared to traditional face-to-face courses and lectures [7]-[14]

- Class work can be scheduled around work and family
- Reduces travel time and travel costs for off-campus students
- Students may have the option to select learning materials that meets their level of knowledge and interest
- Students can study anywhere they have access to a computer and Internet connection
- Self-paced learning modules allow students to work at their own pace
- Flexibility to join discussions in the bulletin board threaded discussion areas at any hour, or visit with classmates and instructors remotely in chat rooms
- Instructors and students both report eLearning fosters more interaction among students and instructors than in large lecture courses

- eLearning can accommodate different learning styles and facilitate learning through a variety of activities
- Develops knowledge of the Internet and computers skills that will help learners throughout their lives and careers
- Successfully completing online or computer-based courses builds self-knowledge and self-confidence and encourages students to take responsibility for their learning
- Learners can test out of or skim over materials already mastered and concentrate efforts in mastering areas containing new information and/or skills

Some of the potential disadvantages of online education could be:

- Learners with low motivation or bad study habits may fall behind
- Without the routine structures of a traditional class, students may get lost or confused about course activities and deadlines
- Students may feel isolated from the instructor and classmates
- Instructor may not always be available when students are studying or need help
- Slow Internet connections or older computers may make accessing course materials frustrating
- Managing computer files and online learning software can sometimes seem complex for students with beginner-level computer skills
- Hands-on or lab work is difficult to simulate in a virtual classroom

The subject “Research in Building Structures” (RBS) is part of the Master in Building Innovation Technology at the UPM, and it has research nature.

This subject has a workload of 6 ECTS and consists of different topics. The Reinforcement of Building Structures is one of the topics of the subject, with a workload of 2.5 ECTS.

Traditionally, this subject has been taught in classroom in the classic way.It has been proved that students have difficulties to attend the classes. However, students do have the time to study and prepare the subject. This situation has been solved by teaching the course in a blended way, being most part of the subject taught online.

With this background it was decided to apply e-learning to this course in order to take in account the advantages of online education.

2 METHODOLOGY

The content relative to the Reinforcement of Building Structures subject is developed as specified in table 1.

The first module introduces the subject and sets out the general considerations that determine the effectiveness of a reinforcement. The workload of the module is 0.2 ECTS. Teaching is classroom based.

The second module discusses the typology of existing reinforcements. This module is primarily descriptive. The workload of the module is 0.3 ECTS. Teaching is online based.

Table 1 Distribution of the workload of the subject.

Module	ECTS	Teaching
General Considerations	0.2	On-site
Reinforcement Typology	0.3	Online
Cases Development	1.5	Online
Conclusions	0.2	On-site
Cases Exposition	0.3	On-site

For the teaching development, the Universidad Politécnica de Madrid (UPM) has an e-learning platform, called GATE. For each topic, the following information has been added:

- A document with theoretical contents. For each type of reinforcement, there is a document that covers the corresponding theoretical development.
- A set of slides that explain the structures reinforcement process (beams, pillars, frameworks…)

The third module is the axis of the subject. The exposition of structure reinforcement cases is developed primarily through the study of experimental works documented in literature. This way students can compare the existing calculation models with experimental results. Comparison is done by matching results obtained analytically by the students with the results published by several authors as a result of their experiments.

This way of teaching this subject has given us very good results since the early 1990s. The workload of the module is 1.5 ECTS. Teaching is online based.

For the development of this module students receive a document in which the reinforcement of a particular structure is covered. This document includes all the data and the results of the process. Students can also download a document that can be used to evaluate this particular structure analytically.

Students are supposed to apply the theory to the experimental cases that they have been given, and have to compare the analytical results that they have obtained with the experimental results.

The fourth module presents the general conclusions. The workload of the module is 0.2 ECTS. Teaching is classroom based.

All modules have the following common sections:

1. A forum for enquiries and problem solving
2. Virtual debates
3. Document reading
4. Self-evaluation tests
5. Team work

Evaluation is done by correcting how the student has developed a building reinforcement case study and by how the student presents his work in front of the class. The workload of the module is 0.3 ECTS. Teaching is classroom based.

3 CONCLUSIONS

The UPM postgraduate students have difficulties to attend the classes; however in most cases they have enough time to study.

The development of study cases is a valid and very interesting alternative as a methodology for the study of building structures reinforcement.

The blended learning of this subject has given very good results. Students have presented excellent works and the presentation of these works has been of high quality. The students have responded correctly to the questions raised during the exhibition of the works.

The use of technology has improved the quality of the teaching process developed in the classroom because of a better and more frequent communication between student and teacher.

The use of ICTs in teaching allows students to have access to information and activities in a continuous manner, which increases their interest and their performance. It has also permitted students to confront cases of real structure pathology and to apply what they have learned about reinforcements. If these technologies were not available, teaching would be limited to theoretical classes or laboratory based, always in a simulated way.

The comparison between analytical and real results has allowed to value the efficiency of the available calculation methods.

The obtained results have encouraged us to expand the number of subjects that will be taught this way next course.

There are many advantages of taking online classes. Students who enroll in online degree programs are able to manage their time, learn the materials that are presented, and complete assignments on their own schedules. This type of learning helps many students learn faster, retain more information, and solve problems related to building structures reinforcement.

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